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United States Patent [19]

Slutter et al.

[11] Patent Number: **5,995,221**[45] Date of Patent: **Nov. 30, 1999**[54] **MODIFIED CONCENTRIC SPECTROGRAPH**4,618,260 10/1986 Okubo.
5,066,127 11/1991 Schwenker.[75] Inventors: **Warren S. Slutter**, Lebanon; **Wu Jiang**, South Plainfield, both of N.J.;
Alain F. R. Thevenon, Bretigny sur Orge; **Viviane D. Millet**, Linas, both of France; **Jeremy J. Goldstone**, Piscataway, N.J.**FOREIGN PATENT DOCUMENTS**2653879 3/1991 France.
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Attorney, Agent, or Firm—Fish & Neave; Jeffrey H. Ingerman; Brett G. Allen[73] Assignee: **Instruments S.A., Inc.**, Edison, N.J.[21] Appl. No.: **08/884,417**[22] Filed: **Jun. 27, 1997****Related U.S. Application Data**

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[51] Int. Cl.⁶ **G01J 3/28**[52] U.S. Cl. **356/326**[58] Field of Search **356/326, 328, 356/330-334; 385/37**[56] **References Cited****U.S. PATENT DOCUMENTS**2,594,334 4/1952 Miller.
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4,575,242 3/1986 Akiyama et al..[57] **ABSTRACT**

A modified concentric spectrograph for diffracting light with high stray light rejection without astigmatism is provided. The modified spectrograph includes a grating, a lens, and at least one entrance port and one exit port. The grating has a concave surface and a meridian plane with a first side and a second side. The lens has a substantially planar surface and a convex surface. Preferably, the convex and concave surfaces are substantially concentric. The ports are substantially located on different sides of the meridian plane near a focal plane of the spectrograph. The position of a focal plane may be modified using an optically transmissive triangular prism with a reflective surface, and an optically transmissive block. The position of a focal plane may further be modified with one or more optically transmissive plates. Methods for using the spectrograph are also provided.

83 Claims, 7 Drawing Sheets